

Listing Of Claims

Claims 1-35 (Canceled)

36. (original) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

an electrically insulating polymer base material configured for deposition onto the substrate or the component as a non-flowing viscous material; and

a plurality of solder particles in the base material configured to melt and to rigidify the connections.

37. (original) The underfill material of claim 36 wherein the particles comprise a eutectic solder.

38. (original) The underfill material of claim 36 wherein the particles have a diameter of from 1 μm to 10 μm .

39. (original) The underfill material of claim 36 wherein the particles have a volume percentage of a total volume of the underfill material of from about 10% to 50%.

40. (original) The underfill material of claim 36 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 50%.

41. (original) The underfill material of claim 36 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 30%.

42. (original) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C; and

a plurality of solder particles in the base material having a volume percentage of a total volume of the underfill material of from 10% to 50% and a melting temperature of from 150°C to 250°C.

43. (original) The underfill material of claim 42 wherein the polymer base material comprises a material selected from the group consisting of epoxy, silicone and polyimide.

44. (original) The underfill material of claim 42 wherein the particles comprise a eutectic PbSn solder.

45. (original) The underfill material of claim 42 wherein the particles comprise a SnAgCu solder alloy.

46. (original) The underfill material of claim 42 wherein the particles have a diameter of from 1 μm to 10 μm .

47. (original) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

a polymer base material having a no flow viscosity at a temperature of from 15.5°C to 37.8°C;

a plurality of solder particles in the base material having a diameter of from 1 μm to 10 μm , a melting temperature of from 150°C to 250°C. and a concentration selected such that the underfill material is non-conductive in X and Y directions; and

a curing agent in the base material configured to cure the base material.

48. (original) The underfill material of claim 47 wherein the curing agent comprises a solvent or a reactant.

49. (original) The underfill material of claim 47 wherein the concentration expressed as a volume percentage of a total volume of the underfill material is from about 10% to 50%.

50. (original) The underfill material of claim 47 wherein the concentration expressed as a volume percentage of a total volume of the underfill material is less than about 50%.

51. (original) The underfill material of claim 47 wherein the concentration expressed as a volume percentage of a total volume of the underfill material is less than about 30%.

52. (original) The underfill material of claim 47 wherein the particles comprise eutectic solder.

53. (original) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

an electrically insulating polymer base material configured for deposition onto the substrate or the component as a non-flowing viscous material; and

a plurality of metal particles in the base material configured to melt and to rigidify the connections, the metal particles comprising a metal selected from the group consisting of Sn, Pb, Ag, Au, Ge, Cu and In.

54. (original) The underfill material of claim 53 wherein the particles have a diameter of from 1 μm to 10 μm .

55. (original) The underfill material of claim 53 wherein the particles have a volume percentage of a total volume of the underfill material of from about 10% to 50%.

56. (original) The underfill material of claim 53 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 50%.

57. (original) The underfill material of claim 53 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 30%.

58. (original) An electronic system comprising:
a semiconductor component comprising a plurality of solder terminal contacts;
a substrate comprising a plurality of substrate contacts;
a plurality of connections between the terminal contacts and the substrate contacts; and
an underfill layer attaching the component to the substrate and encapsulating the connections, the underfill layer comprising a polymer base material and a plurality of conductive particles in the base material at least some of which are bonded to the connections and the substrate contacts.

59. (original) The system of claim 58 wherein the substrate comprises a module substrate and the system comprises a multi chip module.

60. (original) The system of claim 58 wherein the particles comprise solder.

61. (original) The system of claim 58 wherein the particles have a diameter of from 1 μm to 10 μm .

62. (original) The system of claim 58 wherein the particles have a volume percentage of a total volume of the underfill layer of from about 10% to 50%.

63. (original) The system of claim 58 wherein the particles have a volume percentage of a total volume of the underfill layer of less than about 50%.

64. (original) The system of claim 58 wherein the particles have a volume percentage of a total volume of the underfill layer of less than about 30%.

65. (original) An electronic system comprising:
a semiconductor component comprising a plurality of terminal contacts comprising a solder alloy;
a substrate comprising a plurality of substrate contacts;
a plurality of connections between the terminal contacts and the substrate contacts; and
an underfill layer attaching the component to the substrate and encapsulating the connections, the underfill layer comprising a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C., and a plurality of conductive particles in the base material configured to alloy with the solder alloy, and having a volume percentage of a total volume of the underfill layer of from 10% to 50% and a melting temperature of from 150°C to 250°C.

66. (original) The system of claim 65 wherein the polymer base material comprises a material selected from the group consisting of epoxy, silicone and polyimide.

67. (original) The system of claim 65 wherein the particles comprise the solder alloy.

68. (original) The system of claim 65 wherein the particles comprise a second solder alloy.

69. (original) The system of claim 65 wherein the particles comprise a metal selected from the group consisting of Sn, Pb, Ag, Au, Ge, Cu and In.

70. (original) The system of claim 65 wherein the particles have a diameter of from 1 μm to 10 μm .

71. (original) An electronic system comprising:
a semiconductor component;
a substrate;

an underfill layer attaching the component to the substrate comprising a polymer base material, and a plurality of solder particles in the base material; and

a plurality of connections between the component and the substrate encapsulated in the underfill layer, at least one of the connections comprising a solder layer comprising a plurality of the solder particles.

72. (original) The system of claim 71 wherein the connections comprise solder terminal contacts on the components.

73. (original) The system of claim 71 wherein the connections, the solder layer and the solder particles comprise eutectic solder.

74. (original) The system of claim 71 wherein the underfill layer has a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C.

75. (original) The system of claim 71 wherein the solder particles have a volume percentage of a total volume of the underfill layer of from 10% to 50%.

76. (original) The system of claim 71 wherein the solder particles have a melting temperature of from 150°C to 250°C.

77. (original) The system of claim 71 wherein the component comprises a semiconductor package, a semiconductor wafer or a semiconductor die.

78. (original) The system of claim 71 wherein the substrate comprises a module substrate and the system comprises a multi chip module.